

filed. Specifically, support for Claim 1, as amended, is found at page 5, lines 14-23 of the specification and shown in Figures 1B and 3. Support for Claim 2, as amended, is found at page 5, lines 12 and 13 of the specification. As a result of this Amendment, taken together with the remarks set forth below, it is respectfully submitted that pending Claims 1-4 are now before the Examiner in condition for favorable consideration and allowance.

In the Office Action, Claim 2 was rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. Specifically, the Examiner indicates that he does not understand what "changing a wall thickness of said Au layer" means and that the specification does not disclose changes in wall thickness. In addition, the Examiner states that there is no antecedent basis for "said Au layer".

As disclosed in the specification at page 5, lines 12 and 13, the step 18 in the electrodes is formed by increasing the thickness of the Cu layer. Accordingly, Claim 2 has been amended to further clarify that the step is formed by changing the thickness of the Cu layer and to provide antecedent basis for the Cu layer. Therefore, it is respectfully requested that the rejection of Claim 2 under 35 U.S.C. § 112, second paragraph, be reconsidered and withdrawn.

Claims 1-4 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,228,676 to Glenn et al. (*Glenn*) in view of U.S. Patent No. 6,066,086 to Höhn et al. (*Höhn*). Specifically, the Examiner indicates that *Glenn* describes an integrated circuit chip packaging device at column 2, line 40 through column 9, line 55, which includes a substrate 12, a pair of electrodes 22 formed on the substrate 12, a step formed in the electrodes within the mold 42 having a height increasing from an outer part to an inner part of the electrodes, and a mold encapsulation 42. Although the Examiner concedes that *Glenn* does not describe the chip as being a light emitting diode (LED), the Examiner states that *Höhn* discloses an LED chip being encapsulated in a mold and that it would have been obvious to one of ordinary skill in the art to encapsulate an LED chip in the *Glenn* package to produce light of different colors.

Regarding Claim 2, the Examiner indicates that *Glenn* describes an electrode 22 that includes a Cu layer and a gold (Au) layer at column 3, lines 1-8. Regarding Claims 3 and 4,

the Examiner states that *Glenn* describes a gold layer as being the uppermost layer at column 3, line 6.

The subject invention is directed to a chip-type semiconductor light-emitting device, which includes a pair of electrodes, a semiconductor light-emitting chip, a mold, and a step. At least one of the electrodes includes an inner portion and an outer portion. The semiconductor light-emitting chip is electrically connected to the pair of electrodes. The mold encapsulates the semiconductor light-emitting chip and the inner portion of at least one of the pair of electrodes.

The outer portion of the at least one of the pair of electrodes extends substantially laterally beyond the mold. The step is formed in the inner portion of the at least one of the pair of electrodes inside the mold and has an height increasing from an outer side to an inner side of the mold, as now defined by amended Claim 1.

Glenn relates to a plurality of integrated circuit chip packages that are fabricated simultaneously on a single insulating substrate. Bonding pads on the chip are electrically connected to metallizations on a top layer of the substrate. The metallizations, chip, bonding pads, and top surface of the substrate are then encapsulated. Interconnection balls or pads are formed at substrate bonding locations on a lower surface of the substrate and are electrically connected to the metallizations. The substrate and encapsulant are then cut to form integrated circuit packages.

However, as shown in Figure 1, the interconnection balls 28 are mounted on the bottom surface of the device and are used to make electrical contact with the mounting surface of a circuit board. Therefore, neither the metallization 22, contact 23, conductive through-hole 14, metallization 26, nor contact 27 extends laterally beyond the encapsulant 42. Thus, *Glenn* is directed to an entirely different mounting method than that of the subject invention.

The subject invention is directed to a method for mounting a chip-type semiconductor having electrodes that extend laterally beyond the encapsulating mold. Thus, a step is formed in the electrode to prevent solder from reaching the metal wire 22 or LED chip 20 during the

reflow process, as disclosed at page 5, lines 14-23 of the specification. In addition, Claim 1 has been amended to further clarify that the chip-type semiconductor light-emitting device is intended for use as a surface mount light-emitting (LED) device, which may be attached to a mounting surface without requiring the substrate shown in Figures 1, 2, 4A, 5A, 6A, 7, and 8A of *Glenn*.

Höhn relates to a wavelength-converting casting composition made of a transparent epoxy resin with a luminous substance. The composition is used to emit homogeneous mixed-color light, which is color-stable under temperature and humidity stresses. However, as shown in Figures 1-5, nothing in *Höhn* would teach or suggest a step formed on the inner portion of an electrode within a mold, in which an outer portion of the step extends laterally beyond the mold, as now defined by amended Claim 1.

Applicant respectfully notes that in order to support a claim of *prima facie* obviousness, the cited references must teach or suggest each and every element of the invention, and there must be a motivation in the references or the prior art to combine the references as suggested. However, none of the art of record teaches or suggests, either alone or in combination, a chip-type semiconductor light-emitting device, which includes a pair of electrodes, a semiconductor light-emitting chip, a mold, and a step, wherein an outer portion of at least one of the pair of electrodes extends substantially laterally beyond the mold and the step is formed in an inner portion of the at least one of the pair of electrodes inside the mold, as now defined by amended Claim 1.

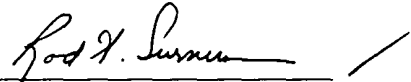
Applicant respectfully submits that Claims 2-4, which ultimately depend from Claim 1, are patentable over the art of record by virtue of their dependency from Claim 1, which is believed patentable for the reasons set forth above. Further, Applicant submits that Claims 2-4 define additional patentable subject matter in their own right. Therefore, it is respectfully requested that the rejection of Claims 1-4 under 35 U.S.C. § 103(a) be reconsidered and withdrawn.

In view of the foregoing Amendment and remarks, entry of the amendments to Claims 1 and 2, favorable consideration of Claims 1 and 2, as amended, favorable reconsideration of Claims 3 and 4, and allowance of pending Claims 1-4 are respectfully and earnestly solicited.

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If there are any questions concerning the above-identified application, the Examiner is respectfully requested to contact the undersigned at the telephone number provided below.

Respectfully submitted,

A handwritten signature in cursive script, appearing to read "Rod S. Turner", is written over a horizontal line. A diagonal slash is present to the right of the signature.

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VERSION OF AMENDMENT WITH MARKS
TO SHOW CHANGES MADE

IN THE SPECIFICATION:

At page 4, replace the paragraph beginning at line 18 with the following:

Furthermore, a translucent-synthetic-resin mold [14] 24 is formed on the upper surface of the substrate 12. The mold encapsulates the protrusion 14b, protrusion 16b, pad 16c, LED chip 20 and metal wire 22.

IN THE CLAIMS:

Please amend Claims 1 and 2 by rewriting the same as follows:

1. (Amended) A chip-type semiconductor light-emitting device, comprising:

[a substrate;]

a pair of electrodes [formed on said substrate], at least one of said pair of electrodes including an inner portion and an outer portion;

a semiconductor light-emitting chip electrically connected to said pair of electrodes;

a mold encapsulating [respective parts of] said semiconductor light-emitting chip [and], said mold encapsulating said inner portion of a least one of said pair of electrodes, said outer portion of at least one of said pair of electrodes extending substantially laterally beyond said mold; and

a step formed in said inner portion of at least one of said pair of electrodes at an inside of said mold [and], said step having a height increasing from an outer side to an inner side [thereof] of said mold.

2. (Amended) A chip-type semiconductor light-emitting device according to claim 1, wherein said electrode includes a Cu layer,[and] said step being formed by changing a [wall] thickness of said [Au] Cu layer.

IN THE ABSTRACT:

Please replace the Abstract with the following:

A chip-type semiconductor light-emitting device includes a semiconductor light-emitting chip connected to a pair of electrodes formed on a substrate. The semiconductor light-emitting chip is molded, together with respective parts of the electrodes, by resin. The electrode has a layered structure having a Cu layer, an Ni layer and an Au layer in [the] that order [of] from the lowermost layer, to have a step formed inside the mold by changing the wall thickness of the Cu layer.